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Publication of the Wyoming Native Plant Society

May 2016, Volume 35(2)

Posted at www.wynps.org

The Importance of Forbs in Big Sagebrush Plant Communities for Greater Sage-Grouse*

By Victoria Pennington and William Lauenroth, Department of Botany, University of Wyoming

The most widespread species of sagebrush in North American drylands is big sagebrush *(Artemisia tridentata*; Schultz 2012). Big sagebrush plant communities consist of a shrub overstory and an understory composed of forbs and grasses. These communities are important because they provide habitat for wildlife species such as Greater Sage-Grouse (Connelly et al 2004). Greater Sage-Grouse is a sagebrush-obligate species that relies on healthy, intact big sagebrush communities year-round for survival. Greater Sage-Grouse populations have declined because of increasing habitat loss and fragmentation due to wildfires, overgrazing, human population expansion, invasive species, and energy development (Nelle et al. 2000, Pedersen et al. 2003, Connelly et al. 2004, Schroeder et al. 2004, Davies 2011, Smith et al. 2014). It was a candidate for listing under the Endangered Species Act in September 2015, and although listing was not considered warranted, it continues to be a species of management concern (USFWS 2015).

Forbs are herbaceous vascular plants found in the understory of big sagebrush plant communities that are not grasses, sedges or rushes. Forbs have been identified as important to Greater Sage-Grouse for three reasons. First, they are an important food source during the spring and summer. Second, they provide concealment from predators. Last, they are host plants for arthropods. Arthropods are closely linked to Greater Sage-Grouse because they are also essential to their diet in the spring and summer. Therefore, we compiled information to determine which forbs are commonly used by Greater Sage-Grouse in their diet and habitat.

Our work synthesizes the current knowledge regarding forbs in big sagebrush plant communities and their importance for Greater Sage-Grouse diet and habitat. Additionally, we compiled information on the relationship between forbs and rangeland management practices, the relationship between forbs and climate, and the implications of these changes for Greater Sage-Grouse populations. Last, we identified additional research needs for effective conservation and management of big sagebrush (Cont. p. 4)

*This article highlights part of Master thesis research and an associated publication: Pennington, V.E., J.B. Bradford, D.R. Schlaepfer, J.L. Beck, K.A. Palmquist, and W.K. Lauenroth. 2016. Sagebrush, Greater Sage-Grouse, and the Occurrence and Importance of Forbs. *Western North American Naturalist, in revision.*

Left: The Dubois badlands will be among many landscapes featured in the 2016 annual meeting. They rise above the Wind River in rainbows of color that support Dubois milkvetch. Habitat photo by Hollis Marriott.

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WYNPS News

Reminder! Please register for the 2016 Annual Meeting in Dubois – the deadline is June 1 to help organizers make arrangements. Now is also a good time to make reservations for camping or lodging. Open to the public.

2016 Markow Scholarship Awards: The two 2016 awardees of the Markow scholarship are:

- Jason Mercer, Department of Botany, University of Wyoming, for *Exploring alternative hydrological niches of rare plants in groundwater dependent mountain peatlands*

- Marian Lea, Department of Integrative Biology, University of Colorado Denver, for *Recovery of genetic diversity in whitebark pine (Pinus albicaulis Engelm.) a quarter century after the 1988 Yellowstone fires*

…We look forward to hearing from them next year!

Chapter News:

Teton Plants Chapter

Tuesday, May 24, 6-8pm, "Gardening with Natives and Managing Invasives," Teton County Library, 125 Virginian Lane, Jackson. www.tetonplants.org

New Members: Please welcome the following new members to WYNPS: Jay Dierks, Laramie; Barry Hildreth, Laramie; Steve Deutsch, Jackson.

Treasurer's Report: Treasurer's report: Balance as of 20 April 2016: Scholarship = $1070.50; general fund = $7822.68; total = $8893.18.

Contributors to this Issue: Karen Clause, Robert Dorn, Bonnie Heidel, William Lauenroth, Victoria Pennington, Dorothy Tuthill.

Deadline for next Issue: Announcements and articles are welcome at any time. The next deadline is 15 Sept.

Wyoming Native Plant Society
P.O. Box 2449
Laramie, WY 82073

Message from the President:

Happy spring everyone! Things are starting to grow, even around Pinedale. Here is an update on the activities of the Board this spring:

We reviewed many excellent scholarship applications, and ended up funding one application at the maximum amount of $1,000 and partially funding another application. Congratulations to the recipients, Jason Mercer and Marian Lea.

Our Secretary/Treasurer, Jeannette Flaig, resigned and the board appointed Dorothy Tuthill in the interim until election are held next winter. Well wishes to Jeanette and a warm welcome to Dorothy. Ann Boelter, past Secretary/Treasurer extraordinaire, has been transferring her wealth of knowledge and records over to Dorothy. I can't thank them enough for their service.

With that, I hope you enjoy the fine newsletter …AND, don't forget to register for the annual meeting in Dubois this June ☺.

~Karen Clause, President

WYNPS Board – 2016

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Native Plant Conservation Campaign:

Championing for Herbaria

Wyoming Native Plant Society is proud to boast on behalf of the Rocky Mountain Herbarium (RM; University of Wyoming), the largest herbarium in the region, and largest between St. Louis and the West Coast. RM is also home-away-from-home for many U-WY alumni, the vital resource for data users and researchers across the country, stomping grounds of high-energy volunteers, and host to a broad fan base. So we are also proud to partner with the Native Plant Conservation Campaign (NPCC) in the call for reinstating National Science Foundation (NSF) funding for herbaria such as RM and similar facilities across the country. NSF funding has been and potentially signifies major support for RM operations and services.

NPCC Director, Emily Roberson, presented the essential functions of herbaria as stimulating discovery, providing the raw materials for expanding and deepening scientific knowledge, and providing treasure troves of information needed to understand change.

The complete NPCC letter is posted at: http://plantsocieties.cnps.org/images/NSFBiolSpecCollec4.15.16NPCC-lett.pdf . Read the full article about critically needed support for herbaria in *Nature*: http://www.nature.com/news/biological-specimen-troves-threatened-by-funding-pause-1.19599. Finally, Wyoming Native Plant Society members are also encouraged to check out Friends of the RM (http://www.uwyo.edu/botany/rm%20friends/) - a group comprised of anyone who is an RM fan.

***Flora of North America* Sale**

Now thru 9 July, most of the published ***Flora of North America*** volumes are on sale at 20% off through the publisher, Oxford University Press (marked down to $76+shipping). If you have always wanted these hardcover references in your library, there's no time like the present. They can be ordered on-line (www.oup.com/academic/biologycatalog) using the Promotion Code: 33789. The specific volumes that are on sale include: Volumes 1, 2, 3, 4, 5, 7, 9, 19, 20, 21, 22, 23, 24, 25, 27 and 28.

2016 WYNPS ANNUAL MEETING – DUBOIS, WY
June 17-20

See you in Dubois! For the complete WYNPS schedule and registration information, go to your March 2016 newsletter or to posted on-line information (http://www.wynps.org/activities/2016-annual-meeting/). Attendees are also encouraged to register ahead for camping/lodging.

The Dubois KOA is our central meeting area where you go to get your registration packet, maps, sign liability waivers, and to meet at the start of hikes. It is also one of the camping options, where Wyoming Native Plant Society attendees have a group discount. *It is located 1 block from town (from Hwy 26/287, turn at the Conoco Station onto Riverton St. and go south 1 block).* You can register at the KOA by mail (225 Welty St., Dubois, WY 82513), by phone (1-800-562-0806) or on-line (www.koa.com/campgrounds/dubois). *Just say that you are with Wyoming Native Plant Society and they will give a 20% discount off the full prices for cabins, tent camping or RV.* A map of hike destinations and trip rosters will be available for viewing at the registration area. Additional camping and lodging information is in the March newsletter.

2016 BIOBLITZ – BELVOIR RANCH
June 11-13

Belvoir Ranch, 16 miles west of Cheyenne, is destination for the 2016 Bioblitz. The Bioblitz is a weekend-long event teaming together community members of all ages, educators, and scientists to document the plant and animal life of an area.

Registration is open from 3-7 pm on Friday and 6-9 am on Saturday, with a Friday evening Keynote presentation at 7 pm by Dr. Dennis Knight, and a weekend full of hikes. All registration and events take place on the Ranch*. People can also register on-line and sign up to get further event details, at: http://wyomingbiodiversity.org/programs/cheyenne-bioblitz-2016/ .

*To get to Belvoir Ranch, go on I-80 to Exit 342 (Harriman Road), and turn south. Go roughly 3 miles on the Harriman Road to the Ranch turn on the east (lefthand) side. From the Ranch entrance there will be signs and flagging to direct you to the registration area.

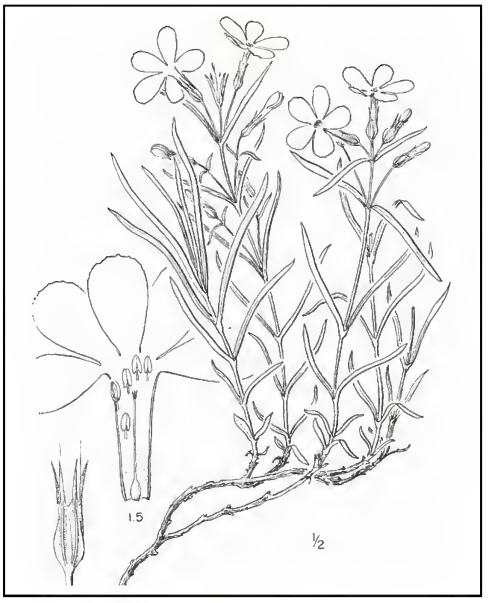
Continued from p. 1

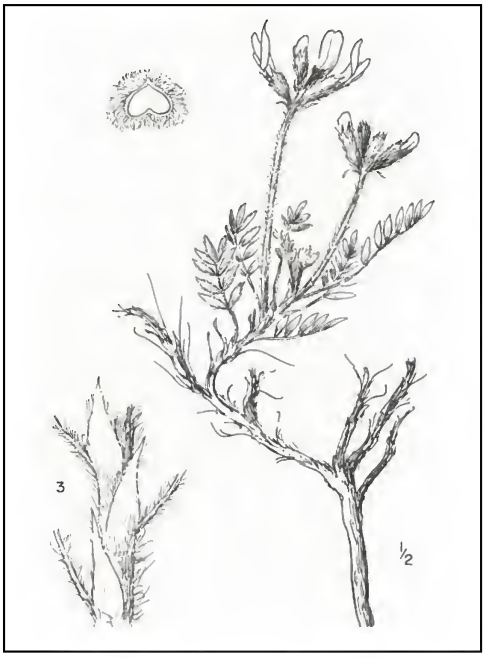
communities. We conducted a literature search through the University of Wyoming Web of Science and Google Scholar. We included peer-reviewed and non-referred journal articles, conference proceedings, books, agency reports, M.S. theses and Ph.D. dissertations. We obtained 68 sources that addressed the explicit Greater Sage-Grouse requirements in big sagebrush plant communities. Diet studies analyzed crop contents or directly observed Greater Sage-Grouse consuming forbs. Habitat studies evaluated microhabitat characteristics at nesting and brood-rearing locations.

Forbs are important because they contain crude protein, calcium and phosphorus, which has been reported to increase Greater Sage-Grouse reproductive success in the spring (Barnett and Crawford 1994, Gregg et al. 2008). Gregg et al. (2008) found that forbs were found in 89% of Greater Sage-Grouse crop dissections and contributed approximately one-third of the aggregate dry mass. In studies conducted in Oregon and Nevada, Greater Sage-Grouse adults consumed 21-22 different food items in the spring, of which 15-16 were different forb species (Barnett and Crawford 1994, Gregg et al. 2008). In the summer, Drut et al. (1994) reported that juveniles consumed 41 invertebrate taxa, 34 forb genera, and 3 grass and shrub genera in Oregon. Invertebrate taxa that were commonly consumed included Coleoptera (beetles), Hymenoptera (ants), and Orthoptera (grasshoppers; Klebenow and Gray 1968, Martin 1970, Peterson 1970, Wallestad and Eng 1975, Drut et al. 1994). Some of the most commonly found families in spring and summer diets were Asteraceae, Fabaceae, and Polemoniaceae.

Forbs also provide essential cover during nesting and brood-rearing life stages because they can decrease visibility to predators (Watters et al. 2002). Therefore, Greater Sage-Grouse often inhabit areas with higher forb cover than the surrounding areas (Dinkins et al. 2016). Watters et al. (2002) suggested that nest success could potentially increase with an 8 to 11% increase in forb cover. Nesting females and broods select for areas where Asteraceae and Fabaceae are present. In addition to providing cover, forbs also influence Greater Sage-Grouse movements: as forbs desiccate throughout the summer, broods relocate to areas where forbs are still green and abundant (Klebenow 1969, Peterson 1970, Wallestad 1971, Fisher et al. 1996, Aldridge and Brigham 2002).

Our analysis uncovered important uncertainties and research needs. Many studies focused primarily on grasses and shrubs, and forbs are excluded from analyses, lumped together as a single group, or only identified to the family or genus level. Greater Sage-Grouse biologists concur that forbs are a vital diet and habitat component. However, we lack information about forbs, particularly at the species level, and about which forbs are used during different life stages (lekking, nesting, and brood-rearing) or at important times of the growing season. More research is needed to fill this knowledge gap. William Lauenroth and Kyle Palmquist (UW) are embarking on a multi-state field study in May 2016 to enhance our understanding of plant species richness in big sagebrush plant communities with a focus on forbs.





The illustrations featured with this article represent a few of the plant species that have been found in the crops of Greater Sage-Grouse hens. Above: *Phlox longifolia*, *Astragalus purshii*. Illustrations by Jeanne R. Janish.
Next page: *Achillea millefolium*. Illustration by John Rumley.
From: *Vascular Plants of the Pacific Northwest*. University of Washington Press, Seattle, WA.

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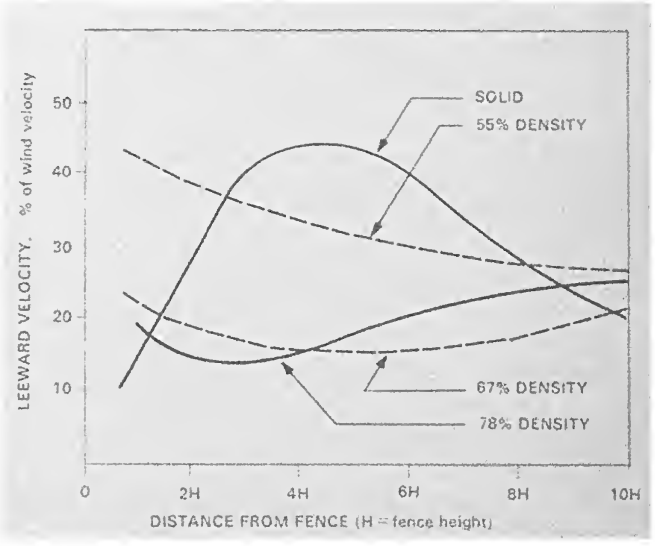
Growing Native Plants

Part 20. Windbreaks and Shelterbelts

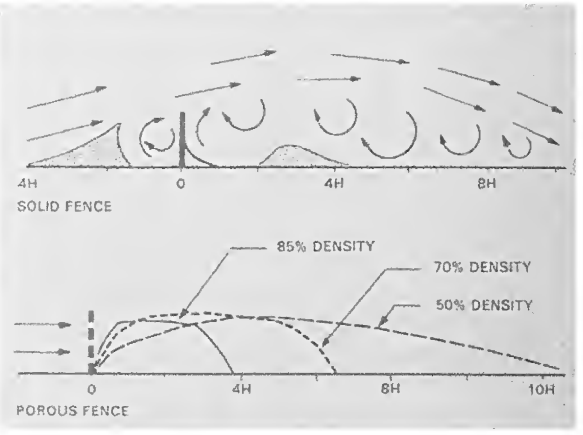
By Robert Dorn

Windbreaks and shelterbelts are usually designed for two primary objectives: to reduce wind exposure and to control drifting snow. There are often secondary objectives or benefits that include sound or vision barriers, wildlife habitat, shade, and moisture accumulation from snow. There are four parameters to consider when designing a windbreak or shelterbelt: height, length, density, and setback. Other factors that should be taken into account include annual precipitation and when it occurs; supplemental irrigation; space available; shape of the windbreak or shelterbelt; soil type and depth; proximity of buildings, roads, driveways, utilities, and easements; prevailing wind direction at different seasons; suitable plant species; weed barriers; and protection from animals at least during establishment.

The four basic parameters of height, length, density, and setback need to be considered in terms of space available, proximity to buildings, roads, and other objects, and the prevailing wind direction that we want to moderate or control snow drifting. The following two graphs illustrate the effects of height and density which are used to determine setback.



Percent of original wind velocity on lee side of windbreak (fence) at different distances based on its height H and density (after Moysey & McPherson, Univ. Saskatchewan in Darby 1978)



Snow drifting pattern for different density fences or windbreaks where H is height of windbreak (Darby 1978)

These graphs show that increased density drops the snow closer to the windbreak and that densities from 55 to 100 percent drop the wind a similar amount at a distance of 10 times the height of the windbreak. Length of the windbreak is often limited by the space available. If space is sufficient, a rule of thumb is to extend the windbreak 100 feet on each end beyond the area to be protected. This compensates for variation in wind direction by about 25 degrees from perpendicular. It may be desirable to have a windbreak that has three sides, or four sides that would completely surround an area. It could even be designed as an enclosing circle which would require fewer plants than a square configuration. Other shapes are possible such as V's or U's or two sides perpendicular to each other.

Height needs to be considered in terms of the mature average height of the plant species being used. Generally the expected height after 20 to 30 years growth is an acceptable figure to use. Since windbreaks usually include several species of different heights, the tallest species is used for height determination. Density and height are interrelated so if density is more important than height, the height of the most dense species can be used for height calculations. To be on the safe side and avoid snow drifting where it is not desired, keep the windbreak at least 150 to 200 feet from the areas where drifts are not desired.

Density can vary greatly from species to species. In general, deciduous species will be the least dense, especially in winter, and coniferous species will be the most dense. The densest are usually Rocky Mountain Juniper and Utah Juniper followed by spruces and firs. The latter two require much more moisture than the former two so are not often used.

Deciduous shrubs have a specific use in windbreaks while deciduous trees are only occasionally included. Spacing of the trees or shrubs will also affect the overall density. If the primary objective is to control snow drifting, spacing may be especially important.

Typical windbreaks include several rows of different species although a single row of a single species can be established. Multiple rows of different species are more effective in moderating the wind or snow drifting and present some protection against insect or disease problems by avoiding a monotype. Generally, the row facing the prevailing wind is a deciduous shrub like Wild Plum or Chokecherry, the next inner row a tree such as Ponderosa Pine or Limber Pine, and the next downwind row or rows of denser species like junipers. Extra rows can be added as desired. Species should be selected considering soil type and depth, natural precipitation or extent of supplemental irrigation, the space available, area to be protected, and the amount of protection desired which is largely a function of density.

Spacing of rows and individual plants depends on the species used and the density desired. Deciduous shrubs are usually spaced 4 to 10 feet between shrubs and 10 to 12 feet between rows or to the next row of taller species. Large trees are spaced 12 to 16 feet apart and 16 to 20 feet between rows or to adjacent rows of smaller plants. Large shrubs or plants like junipers are spaced 8 to 12 feet apart and 16 to 20 feet between rows or to adjacent rows of other species. If greater density is desired, the shorter distances are used.

Even if natural precipitation is adequate for the species selected, it may be desirable to supply supplemental irrigation at least for a time. This may be especially critical when establishing the young trees and shrubs. In addition, supplemental irrigation will help the plants to attain a desirable size much faster. The photo below shows 12 years of growth starting with 6 to 8 inch seedlings with supplemental irrigation in Goshen County, Wyoming. The rows are left to right: row 1 deciduous shrubs, mostly Wild Plum, row 2 Ponderosa Pine, rows 3 and 4 Rocky Mountain Juniper. Annual precipitation for this 12 year period averaged 13.97 inches (range 6.67 to 21.09 annually). May through September precipitation averaged 65 percent of the total annual precipitation ranging from 50 to 82 percent.

We have had good success by first putting down a 4 foot wide weed barrier for each row. The barrier is slit at each point where a plant is to be placed, the slits large enough to accommodate the mature trunk size or large enough to set in the plant, whichever is greater. Once the plants are set, irrigation tubing can be laid out and staked down. We use 5/8 inch inside diameter tubing with 2 gallon per hour drippers. One half hour of irrigation once a week during the growing season is usually adequate. If significant precipitation occurs, the irrigation can be skipped for that week.

Closer view of Ponderosa Pine row showing weed barrier and irrigation tubing

If you are irrigating from a domestic well, you can irrigate each row on a different day to put less stress on the water system. This will require putting in valves to direct flow to each row separately.

Protection from animals like pocket gophers, rabbits, and deer is especially critical when establishing young plants. Fencing or cages may be needed to deter rabbits and deer. Gophers can often be discouraged by placing sulphur around the young plants. (Cont., p. 8)

Continued from p. 7

Following is a list of recommended native species. Select species based on your soils and climate. Most of these are adaptable to several soil types.

Deciduous shrubs: *Prunus americana*, Wild Plum; *Prunus virginiana*, Western Chokecherry; *Ribes aureum*, Golden Currant; *Amelanchier alnifolia*, Western Serviceberry; *Cercocarpus ledifolius*, Curlleaf Mountain mahogany; *Ericameria nauseosa*, Rubber Rabbitbrush.

Tall coniferous trees: *Pinus ponderosa*, Ponderosa Pine; *Pinus flexilis*, Limber Pine; *Picea glauca*, Black Hills Spruce.

Short coniferous trees/shrubs: *Juniperus scopulorum*, Rocky Mountain Juniper; *Juniperus osteosperma*, Utah Juniper; *Pinus edulis*, Pinyon Pine.

Local Conservation Districts usually have some native plants available for purchase as well as other supplies. They may also have a cost sharing program.

Reference Cited

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Wyoming Native Plant Society is a non-profit organization established in 1981 to encourage the appreciation and conservation of the native plants and plant communities of Wyoming. The Society promotes education and research through its newsletter, field trips, annual student scholarships and small grants awards. Membership is open to individuals, families, or organizations. To join or renew, you can do it on-line (www.wynps.org) or return this form to:

Wyoming Native Plant Society
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Laramie, WY 82073

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[ ] WYNPS annual membership: $10; or
[ ] WYNPS annual membership with scholarship support: $20 ($10 for membership and $10 for Scholarship fund)
[ ] WYNPS Lifetime membership: $300 ($150 for membership and $150 for Scholarship fund)

In addition to the statewide organization, we have two chapters. Membership in chapters is optional; chapter members must also be members of the statewide organization.
[ ] **Sublette Chapter** annual membership: $5.00
[ ] **Teton Plants Chapter** annual membership: $5.00

Total enclosed: _____ THANK YOU!

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